

TP 4755E

**INTERCITY DOUBLE-DECK COACH
DEMONSTRATION 1983:
4-AXLE NEOPLAN SUPER SKYLINER N128/4**



**PREPARED FOR THE
TRANSPORTATION DEVELOPMENT CENTRE
TRANSPORT CANADA**

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**BY
PACIFIC COACH LINES LTD. AND COMMUNICATIONS GILLIES INC.**

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The contents of this report reflect the views of the contractor and not necessarily the official views or policies of the Transportation Development Centre.

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17. Abstract This report documents the results of a service demonstration of the Neoplan, double-deck, Super Skyliner N128/4 (4-axle) coach. The objective of the demonstration was to ascertain the technical merits of operating the Type N128/4 coach on selected PCL routes, and to compare these merits with those identified for the Type N122/3 (3-axle) double-deck coach as a result of an earlier demonstration. The N128/4 was borrowed from Neoplan-USA/Rolf Ruppenthal and Associates Ltd. in January 1983 and was operated on a regular service from January 17th to January 21st, 1983. In general, PCL was pleased with the findings of the demonstration. The Neoplan Model N128/4 coach offers significant economic and technical advantages over conventional intercity coaches and features design aspects found to be more suitable to PCL operations than those of the N122/3. The acquisition of double-deck coaches is recommended, and in the short term, importation of such coaches is the only available option because of a lack of current availability of Canadian made double-deck coaches.					
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15. Remarques additionnelles Le rapport connexe TP4422 décrit un essai semblable par la PCL en janvier 1982 (Skyliner Neoplan, 3 ponts arrière)	17. Résumé Ce rapport présente les résultats de la mise en service expérimentale d'un autocar à impériale Super Skyliner N128/4 (4 ponts arrière) de marque Neoplan. Cet essai avait pour objet de déterminer les avantages techniques de l'exploitation d'un véhicule de type N128/4 sur des itinéraires choisis par la PCL, et de comparer ces avantages avec ceux identifiés pour le type N122/3 (3 ponts arrière) suite à une démonstration précédente. Le véhicule de l'essai, qui avait été emprunté de Neoplan - USA/Rolf Ruppenthal and Associates Ltd., en janvier 1983, a été mis en service régulier entre le 17 et le 21 du même mois. La PCL se dit généralement satisfaite des résultats de l'expérience. L'autocar à impériale Neoplan, type N128/4, ayant affiché une nette supériorité technico-économique sur les autocars de type conventionnel, prouve que ce modèle convient plus spécifiquement aux opérations de la PCL que le type N122/3. L'acquisition d'autocars à l'impériale est recommandée. Cependant l'importation à court terme de ces derniers est indiquée étant donné la pénurie d'autocars manufacturés au Canada.	
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1.0 INTRODUCTION

1.1 Background

Pacific Coach Lines Ltd. (PCL) and their predecessor, Vancouver Island Coach Lines Ltd., have been investigating the possibility of the introduction of high capacity coaches since the mid-1970's.

The problems encountered in obtaining equipment suitable for operation in North America resulted in PCL contacting the Transportation Development Centre of Transport Canada in 1979 whereupon jointly sponsored studies were undertaken to review specific aspects of PCL equipment requirements. These studies resulted in two reports dealing with double-deck buses.

"Inter-Modal Efficiency of the Vancouver Victoria Bus/Ferry Service and A Baseline Design for a Canadian Double-Deck Bus." Pacific Coach Lines, November 1981, TP3387.

"The Double-Deck Bus: A Transport and Industrial Opportunity for Canada". Pacific Coach Lines, December 1981, TP3181.

The interest generated by these reports and an on-going dialogue with the West German manufacturer of Neoplan coaches and the North American distributor, Rolf Ruppenthal and Associates, resulted in a loan to PCL of a three-axle, 12 metre, 72 passenger double-deck coach for a service demonstration during January 1982. This demonstration has been documented in the report,

"Intercity Double-Deck Coach Demonstration, 1982: 3-axle Neoplan Skyliner. Pacific Coach Lines, April 1983, TP4422.

The economic benefits identified during the three-axle, 72-passenger double-deck coach demonstration were significant. Rolf Ruppenthal and Associates were then approached regarding the possibility of a short term trial of a four-axle, 15 metre, Neoplan Super Skyliner M128/4. This

vehicle had been imported into the USA for use in a long term demonstration between the cities of Boulder and Denver, Colorado. The demonstration is to be funded by the US Department of Transport's Urban Mass Transportation Administration. Before the start of the US demonstration a sales tour was conducted by Rolf Ruppenthal and Associates. The vehicle was then made available to PCL for a short term trial in January of 1983.

2.0 SERVICE DEMONSTRATION: (January 17th to 21st, 1983)

2.1 Demonstration Vehicle-Neoplan Super Skyliner N128/4

The Skyliner and Super Skyliner intercity coaches are manufactured by Gottlob Auwärter GMBH and Co. in Stuttgart - Mohringen, West Germany and marketed under the trade name Neoplan. Sales in North America are handled by Rolf Ruppenthal and Associates in Boulder, Colorado who commissioned the construction of the four-axle, 15 metre Super Skyliner N128/4 during the later part of 1982. The subject vehicle was shipped to the United States in October 1982 and, after a sales demonstration tour of the USA, was made available to Pacific Coach Lines during January 1983.

The vehicle is built to the following specifications:

Length	14.9 m	(49 ft. 0 in.)
Width	2.6 m	(8 ft. 6 in.)
Height	4.1 m	(13 ft. 6 in.)
Gross Vehicle		
Weight GVW	29,220 kg	(64,374 lb.)
Turning Radius		
to Outside Corner	15 m	(49 ft. 3 in.)
Swept Path	7.3 m	(24 ft. 0 in.)
Front Overhang	3.2 m	(10 ft. 7 in.)
Tandem Axle		
Spacing	1.2 m	(4 ft. 0 in.)
Wheel Base		
(btwn #2 & #3 Axles)	6.7 m	(21 ft. 11 in.)
Rear Overhang	2.5 m	(8 ft. 4 in.)
Power Unit	Detroit Diesel 8V92TA 445 HP Turbo-charged 2-stroke Diesel	
Transmission	Allison - HT740D - 4 speed automatic.	
Seating Capacity		
Lower Deck	32 passengers.	
Upper Deck	67 passengers.	
Landed Cost Including		
Duty and Taxes	\$493,500.00 Cdn.	

2.2 Schedule

The vehicle was operated by PCL from January 17th through January 21st, 1983. The schedule was as follows:

Monday 17 January

Familiarization and testing in the Greater Victoria area.

Tuesday 18 January

8:05 am Victoria	Nanaimo 9:55 am
10:30 am Nanaimo	Vancouver 1:20 pm
3:50 pm Vancouver	Victoria 7:15 pm

Wednesday 19 January

Evaluation by PCL Board of Directors in the Greater Victoria area.

Thursday 20 January

8:00 am Victoria	Vancouver 11:15 am
4:40 pm Vancouver	Chilliwack 6:40 pm

Friday 21 January

5:45 am Chilliwack	Vancouver 7:30 am
7:50 am Vancouver	Victoria 11:15 am
12:00 am Victoria	Vancouver 3:15 pm
3:50 pm Vancouver	Victoria 7:15 pm

2.3 Driver Training

Because of the short duration of the trial, PCL limited driver training to a brief familiarization with the controls and the handling characteristics of the vehicle. This approach had proven to be quite sufficient for safe and effective operation during the January 1982 demonstration of the three-axle vehicle. The excellent heated, western-style mirrors, which are standard equipment on the Neoplan coaches, provide a full view of both sides of the coach from road to roof. All of the drivers involved found the Super Skyliner was easily positioned on the road despite its greater width, height and length.

2.4 Passenger Demand

The number of passengers carried by the double-deck coach during the service demonstration is detailed in Table 1. "Ex depot" passengers are those who boarded the coach at the terminal. The total passenger count includes both ex depot passengers and those who boarded the coach enroute.

The results demonstrated that on the lower Mainland (Vancouver-Chilliwack) and Vancouver Island trips (Victoria-Nanaimo) the capacity of the double-deck coach was not justified. This confirmed the Companies' views that high capacity vehicles are best suited to the cross-water services between Vancouver and Nanaimo or Victoria.

TABLE 1: Demonstration Statistics

DATE January	DEPARTURE	ROUTE	DISTANCE (km)	PASSENGER COUNT	
				Ex depot	Total
17	8:05 am	Victoria-Nanaimo	122	16	32
	10:30 am	Nanaimo-Vancouver	28	36	53
	3:50 pm	Vancouver-Victoria	68	48	53
20	8:00 am	Victoria-Vancouver	68	48	65
	4:40 pm	Vancouver-Chilliwack	108	28	54
21	5:45 am	Chilliwack-Vancouver	108	5	23
	7:50 am	Vancouver-Victoria	68	35	55
	12:00 noon	Victoria-Vancouver	68	82	108
	3:50 pm	Vancouver-Victoria	68	81	101

2.5 Fuel Consumption

Fuel consumption of the Neoplan Super Skyliner N128/4 was monitored from Lamar to Victoria and throughout the service demonstration. Table 2 lists the results. The fuel consumption recorded for the service demonstration is somewhat greater than that which PCL would expect in normal revenue service. The demonstration included static testing routines and prolonged periods of idling which would not occur in normal service where it is company policy to shut down engines at the earliest opportunity. It is estimated

that the fuel consumption under normal operating conditions would be approximately 60 litres per 100 kilometres. This rate compares favourably with PCL's current fleet average of 51.37 litres per 100 kilometres.

TABLE 2: Fuel Consumption of the Super Skyliner N128/4

Item	Lamar to Victoria Service Demonstration		Total
Distance	2877.4 km (1788.0 miles)	851.3 km (529.0 miles)	3728.7 km (2317.0 miles)
Fuel	1454.7 L (320.0 gal.)	641.0 L (141.0 gal.)	2095.7 L (461.0 gal.)
Oil	9.1 L (8 quarts)	4.5 L (4 quarts)	13.6 L (12 quarts)
Fuel Consumption	50.56L/100 km (5.59 mpg)	75.14L/100 km (3.75 mpg)	56.65L/100 km (5.03 mpg)

2.6 Maintenance

The mechanical design of the Super Skyliner was superior to the N122/3 Skyliner which was tested in 1982. Only one major mechanical problem occurred during the demonstration period. During the delivery trip from Lamar to Victoria extreme low temperatures were experienced which, as a result of an incorrectly routed air line, created an ice blockage in the line. This blockage resulted in continuous running and subsequent failure of the air compressor. The compressor was replaced by PCL in Victoria at a total cost of \$593.51.

2.7 Employee Acceptance

The possibility of introducing high capacity, state of the art intercity double-deck coaches to Pacific Coach Lines' route network has met with almost universal acceptance by both staff and management. This positive response resulted in good co-operation during the revenue demonstrations of both the three and four-axle double-deck coaches.

PCL's Traffic Manager rode on the coach throughout the revenue demonstration and conducted interviews with both drivers and passengers. While some drivers had initial misgivings about the low seat position they quickly adapted to the different perspective and did not experience any problems with these oversize vehicles. The "wide-stance" air suspension and the independent suspension features on axles one, two and four resulted in ride and handling characteristics which were considered to be superior to those of conventional North American coaches.

Particularly noticeable was the remarkable degree of stability exhibited by the double decker on fast highway curves where the conventional North American coach shows significant lean. The braking on the 29,200 kg GVW vehicle was exceptionally smooth and reassuring as was the overall performance provided by the Detroit Deisel 8V92TA/Allison HT740D power trains.

There are minor problems with the vehicle related to the fact that it was not built to PCL's specification and these are covered in para. 2.9. The area of major concern to the drivers was the limited freight capacity and the fact that the passenger luggage had to be lifted into the confined area above the engine compartment. Another area of concern to the drivers was the lack of supervision on the top deck as the subject vehicle was not fitted with a periscope or closed circuit TV surveillance system.

Although the PCL mechanics had no access to maintenance manuals, drawings, bulletins or spare parts the maintenance department has proven their ability to fabricate parts where required and promptly return the vehicle to revenue service.

Exterior washing and interior cleaning are less efficient than on a conventional coach as the wash rack facilities will not take the over height vehicle. The number of man-hours required to wash and clean the double-deck coach manually compared favourably with the amount of time required to clean the two conventional coaches that would be utilized to provide the same passenger seating capacity.

Turn around time with the dual entry double-deck vehicle was found to be no slower than that of conventional vehicles. In one instance, necessitated by delays in ferry and road traffic, the Neoplan arrived at the Vancouver terminal with 90 passengers, discharged these passengers and their baggage and then reloaded with 82 passengers, their baggage and freight all within 9 minutes.

2.8 Passenger Acceptance

Passenger acceptance of the double-deck coach was generally very favourable. Complaints were limited to the lack of minor convenience items such as foot rests. (These were not included in the subject vehicle but would be specified for the PCL coaches). Many of the passengers commented on the large windows, stylish seats and the general feeling of spaciousness, this despite the fact that the ceiling heights on both decks are considerably lower than those on standard North American coaches.

Elderly passengers commented favourably on the single step into the coach and the flat aisle on the lower deck although it was noted that the stairs did not deter many of these passengers from taking advantage of the improved view from the upper deck.

The ratio of seats between the upper and lower decks appeared to be in almost exact proportion with the preferred seating location of the passengers and even when the coach was being operated at near capacity some space remained available on both decks.

The intrusion of the front wheel arches into the lower deck passenger cabin whilst appearing to be a disadvantage at first sight, actually offered two features which met with general passenger acceptance. The area over the wheel arches served as a convenient location for carry on baggage and the rearward facing seats immediately behind the wheel arch became a favourite location for family foursomes and business groups who made full use of the table provided in that location.

As an example of the public acceptance the following is a sampling of the comments made by the passengers:

"It's a really beautiful bus. Very enjoyable to ride."

"Excellent riding!"

"It's beautiful! Hope it's on the Chilliwack express run every day!"

"A very comfortable bus; lots of room. Could save money filled to capacity."

"Would prefer taller seats, otherwise super!"

"It's a great bus but more leg-room would be nice!"

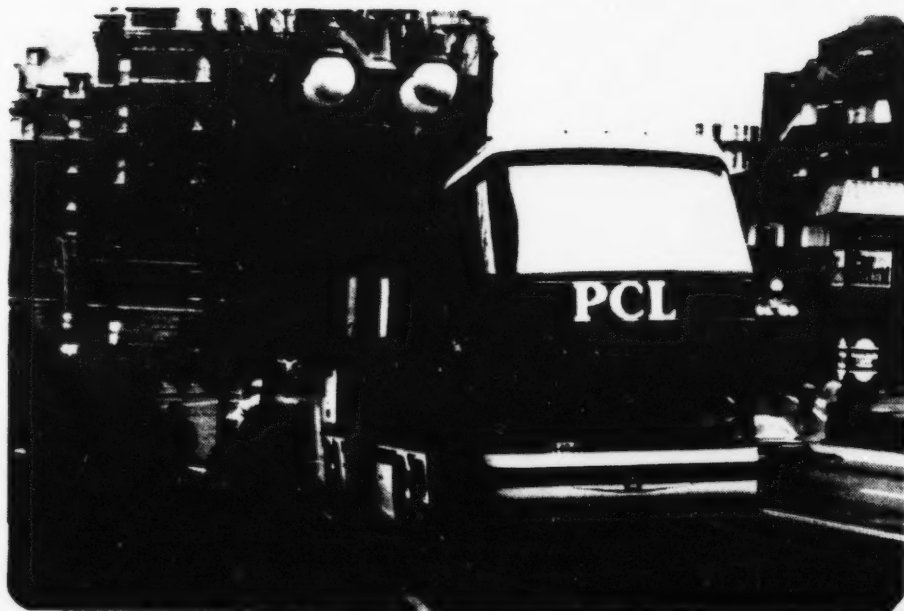
"Like a low flying Loughheed Tristar!"

"Excellent ride - but will this mean higher bus fares?"

"This is the most marvellous bus I've ever seen. I hope we can take the bus every day."

"The only thing missing was the champagne!"

"A very great experience; I hope we do it soon, regularly."



Neoplan Super Skyliner N128/4 in Service

3.0 TECHNICAL AND OPERATIONAL EVALUATION

3.1 Technical

The demonstration vehicle was not built to PCL specifications and therefore exhibited shortcomings in a number of areas which would be automatically corrected in a vehicle constructed for PCL requirements.

The multi-modal coach/ferry service requires that the vehicle be able to maneuver over ramps which will be at varying angles depending on the state of the tide, therefore, the design must be modified to reduce the front overhang and to provide a 10cm (4 inch) suspension lift capability. In addition skid plates will have to be provided under the front, rear and centre of the coach to prevent damage in the event of grounding on the ferry ramps.

The suspension, braking and steering are excellent. Some attention will have to be given to weight balance in order to remain within the maximum legal allowance of 9,100 kg on the drive axle and 6,700 kg on the other three axles.

The ducted air heating and ventilating system on the subject vehicle, although not up to North American standards, showed a considerable improvement over the convection heating and multiple evaporator system on the previous model. However this system installed on the demonstration vehicle is undergoing further refinement by the manufacturer (Sutrak) hence PCL's experience with the system cannot be considered typical.

The electrical system, a major cause of concern on the previous demonstration vehicle, has been improved and only minor modifications would be requested to meet PCL's specifications. No electrical problems were experienced during the test.

The Detroit/Allison power train provides a level of performance comparable with that of conventional coaches but with a markedly improved automatic gear shift. Even at full load this vehicle was able to maintain schedules and otherwise perform comparably with standard coaches.

3.2 Operational

The additional height and length of the vehicle was not a problem on the highway. The turning circle and swept path are approximately equal to that of the standard GMC 4905 intercity coach and the height is identical to that of a standard tractor trailer unit. It was found necessary to exercise extreme caution in certain parts of the city of Victoria where ornamental lamp standards project into the travelled portion of highway less than 13 foot 6 inches above the ground and where many tree branches also encroach into the air space required by the double-deck vehicle. The canopy height at most of the major PCL terminals does not provide adequate clearance for the double decker and it was therefore necessary to park clear of the canopies. As Pacific Coach Lines have previously operated 14 foot 6 inch high British double deckers in sightseeing service, the Victoria maintenance facilities have been adapted to over-height vehicles and undercover maintenance of the vehicle was therefore possible. Washrack facilities are only capable of handling conventional coaches which necessitated exterior washing by hand.

Loading and unloading of baggage and freight was less convenient on this vehicle than on conventional coaches because of the height of the baggage area and the uneven floor of the baggage compartment. PCL's specification for the vehicle calls for the deletion of the rear pair of seats on the left hand side of the lower deck and construction of a freight compartment accessible by a full height door on the left hand outside of the vehicle together with the redesigned configuration of the baggage area. This modification would ensure adequate space and accessibility for both baggage and freight.

3.3 Economic Model

Table 3 shows the estimated cost differential between the operation of conventional 53 passenger coaches and that of 97 passenger double-deck coaches, for varying passenger loads per departure. It has been estimated that the overall increase in cost of operation of the 97 passenger double-decker versus the 53 passenger conventional will be 15.1% in PCL's multi-model Vancouver - Victoria service. For purposes of comparison, factors ranging from 12.5% to 25% have been

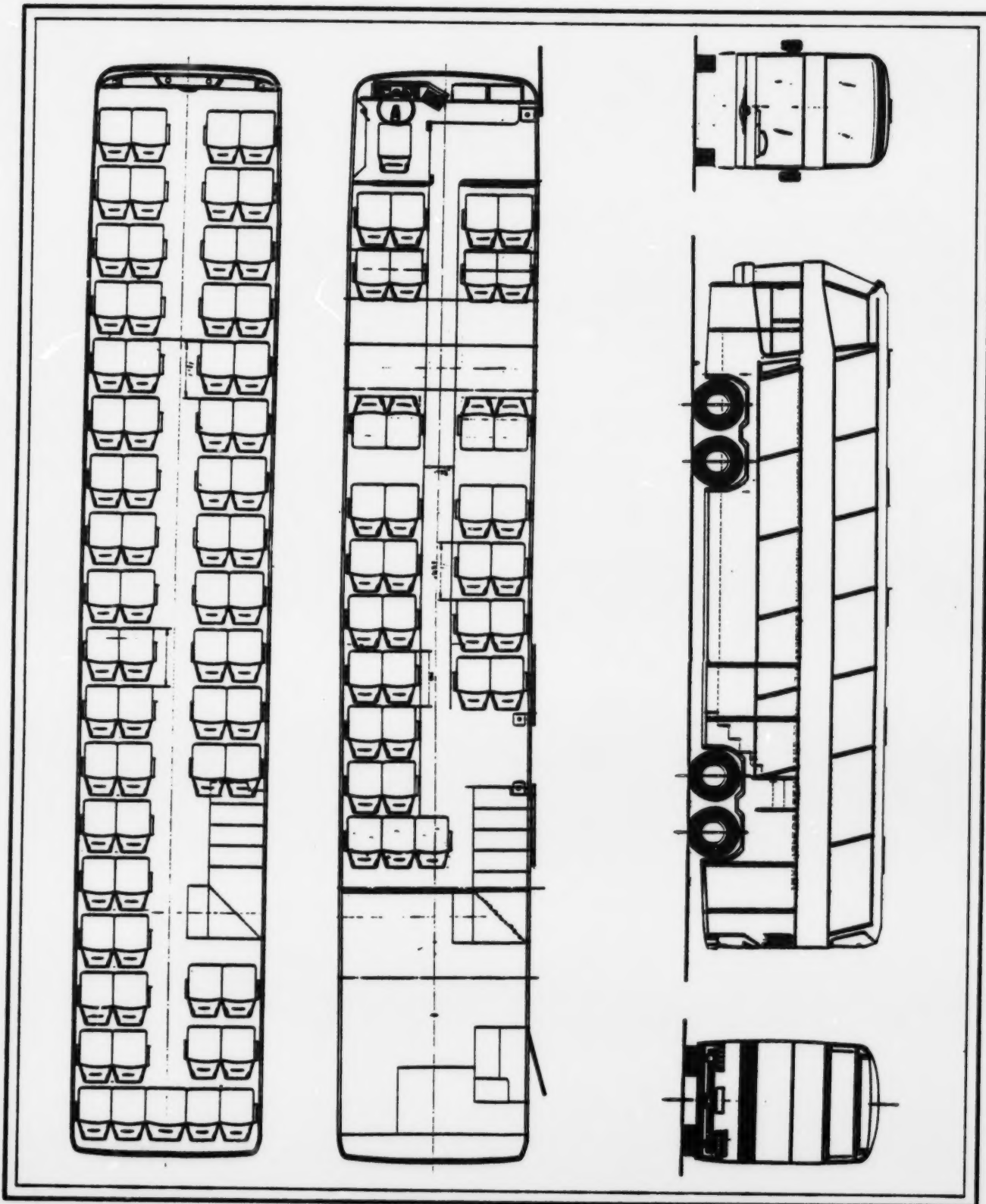
tabulated. It has been estimated that if PCL had been operating the Vancouver - Victoria route throughout 1982 with a fleet comprised entirely of 97-passenger double deckers the cost of operation for that route would have been reduced by 31.73%.

Table 3: Operational and Maintenance Cost Comparisons

Passengers per Departure	Fleet make up	% increased (decreased) operating and maintenance costs for mixed and double-deck fleets			
01-53	1DD *	+ 12.50 %	+ 15.00 %	+ 20.00 %	+ 25.00 %
54-97	1DD	-(43.75)	-(42.50)	-(40.00)	-(37.50)
98-106	1DD+1C **	+ 6.25	+ 7.50	+ 10.00	+ 12.25
107-150	1DD+1C	-(29.16)	-(28.33)	-(26.66)	-(25.00)
151-159	1DD+2C	+ 4.16	+ 5.00	+ 6.66	+ 8.33
160-203	1DD+2C	-(21.87)	-(21.25)	-(20.00)	-(18.75)
204-212	1DD+3C	+ 3.12	+ 3.75	+ 5.00	+ 6.25
213-256	1DD+3C	-(17.50)	-(17.00)	-(16.00)	-(15.00)
257-265	1DD+4C	+ 2.50	+ 3.00	+ 4.00	+ 5.00
266-309	1DD+4C	-(14.58)	-(14.16)	-(13.33)	-(12.50)
01-53	1DD	+ 12.50%	+ 15.00%	+ 20.00%	+ 25.00%
54-97	1DD	-(43.75)	-(42.50)	-(40.00)	-(37.50)
98-106	2DD	+ 6.25	+ 7.50	+ 10.00	+ 12.50
107-159	2DD	-(29.16)	-(28.33)	-(26.66)	-(25.00)
160-194	2DD	-(46.87)	-(46.25)	-(45.00)	-(43.75)
195-212	3DD	-(21.87)	-(21.25)	-(20.00)	-(18.70)
213-265	3DD	-(37.50)	-(37.00)	-(36.00)	-(35.00)
266-291	3DD	-(47.91)	-(47.50)	-(46.66)	-(45.83)
292-318	4DD	-(31.25)	-(30.83)	-(30.00)	-(29.16)
319-371	4DD	-(41.07)	-(40.71)	-(40.00)	-(36.28)

* DD - Double-Decker

** C - Conventional Coach



Neoplan Super Skyliner N128/4

4.0 CONCLUSIONS & RECOMMENDATIONS

The inter-city coach is generally accepted as the most cost effective way of moving passengers for distances of up to 500 km. One of the objectives of Pacific Coach Lines is to introduce equipment which will make the intercity coach not only the most fuel efficient means of travelling up to 500 km but also the preferred means; equipment that will provide standards of passenger accommodation equal to, or better than, that of other modes of transport, and that is cost effective for both passenger and operator. Passengers' comments received during the two double-deck demonstrations conducted by PCL indicate that the high capacity, double-deck coach is a vehicle well suited to further enhance inter-city bus transportation.

PCL's research projects with the Transportation Development Centre, including a current effort to develop a life cycle costs evaluation guide for new coach procurement, have convinced PCL of the wisdom in acquiring double-deck coaches. A Canadian double-decker would be preferred, however in spite of repeated efforts, including PCL involvement in, and endorsement of three proposals to the Federal Government, a suitable Canadian product has not been forthcoming. The most optimistic forecast, short of a concentrated, high priority effort by Canadian manufacturers with government support, is the importation of partially completed vehicles for final assembly in Canada.